

First record of the carpenter bee *Xylocopa pubescens* (Hymenoptera, Apidae) in the Canary Islands confirmed by DNA barcoding

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Abstract

Island ecosystems are particularly vulnerable to the introduction of exotic species that can have an impact on local fauna and flora. Here, the carpenter bee *Xylocopa pubescens* is reported in Gran Canaria (Canary Islands, Spain) for the first time. This species is native to North Africa and the Near East and shows a rapid dispersion across the city of Las Palmas de Gran Canaria, together with a single record in the southernmost tip of the island. Different hypotheses about its arrival to the island are discussed.

Keywords

Canary Islands, Exotic species, range expansion, new record, social media, wood nesting bees

Introduction

Bees of the genus *Xylocopa* are characterised by a large size (13–30 mm) and robust jaws used for cutting the corolla of tubular flowers to extract the nectar, and also for their nesting habits, mainly in trees and wooden structures. The genus has 469 species grouped into 38 subgenera (Ascher and Pickering 2020) and is distributed throughout the World with a high level of diversification in tropical and subtropical areas (Michener 2007). In Europe, the genus has seven species whereas in North Africa there are six known species (Terzo and Rasmont 2014).

Several species of *Xylocopa* have been introduced into both continental (Dahlberg et al. 2013) and island ecosystems (Okabe 2010), mainly due to wood imports. For example, *Xylocopa sonorina* Smith, 1874 has been introduced into several Pacific islands (Hurd 1958; Barrows 1980). More recently *Xylocopa tranquebarorum* (Swederus, 1787) has been reported for the first time in Japan (Okabe 2010).

In the Canary Islands, despite their proximity to the African continent (Fuerteventura is 96 km off the northwest coast of Morocco), there were no representatives of the genus until 2013–2014, when *Xylocopa violacea* (Linnaeus, 1758) was recorded for the first time on the south of the island of Gran Canaria (Ortiz et al. 2016). This species has spread throughout the island in the last years (C. Ruiz *pers. obs.*).

The arrival of an exotic species can lead to negative impacts on ecosystems such as competition with native pollinators for floral and nesting resources, or the introduction of new pathogens (Kawazoe et al. 2010). They can also have negative effects on native flora (Barrows 1980), as damaging flowers due to nectar robbery without pollinating them (Dedaj and Delaplane 2004). In addition, carpenter bees can be a nuisance to humans, due to their ability to nest in human structures, such as fences or wooden roofs. In insular ecosystems, these impacts can be exacerbated due to the vulnerability of island ecosystems to invasive species (Reaser et al. 2007), which are the primary threat to island invertebrates (Leclerc et al. 2018).

Early detection of invasive species is therefore one of the most important actions to ensure the success of control or eradication campaigns, as it reduces costs and potential damage. In this context, citizen science has proven as an effective tool for early detection of exotic species irrespective of their invasive potential (Thomas et al. 2017; Poland and Rassati 2019). Herein, we report the first record of a second exotic *Xylocopa* species for the Canary Islands, *Xylocopa pubescens* Spinola, 1838, based on data published on social media and confirmed using DNA barcoding for the species identification.

Methods

From June to October 2020, several observations were made of a new species of *Xylocopa* by the authors and in social networks such as Facebook ('Fauna Vertebrada e Invertebrada de las islas Canarias' and 'Sociedad Entomológica Canaria Melansis') and Whatsapp groups. For each species observation (captures included), we obtained

photographic evidence from authors and asked them to provide the following information: date/period, number of individuals observed and location with GPS coordinates.

In order to confirm the identification, DNA from a single leg of a captured individual was extracted and amplified in a single step using Phire Animal Tissue Direct PCR Kit (Thermo Scientific) and standard barcoding primers (LCO1490, HCO2198).

Results

New records

Xylocopa (Koptortosoma) pubescens Spinola, 1838

New records. SPAIN: Canary Islands, Gran Canaria, **Las Palmas de Gran Canaria.** 1 ♀ Ciudad Jardín, 11 Jun. 2020, Kings Ruly *obs.*; several *ex.* Parque Doramas, 28.120, -15.428, Jun. 2020, Pablo Martínez Darve *obs.*; 1 ♀ Mercado central, 06 Jul. 2020, 28.133, -15.432, Manuel Betancor *obs.*; 1 ♀ Playa de las Canteras, 28.142, -15.432, 18 Aug. 2020; 1 ♀, 1 ♂ Parque Doramas, 28.120, -15.428, 2 Oct. 2020, Manuel Arechavaleta *obs.*; 4 ♀, 5 ♂, Parque de La Ballena, 28.1052, -15.4424, 30 Sept. 2020, M. Naranjo *obs.*; 1 ♀, 1 ♂ Urbanización Las Filipinas, 28.0761, -15.4198, 25 Sept. 2020, M. Naranjo *leg.*

SPAIN: Canary Islands, Gran Canaria, **Maspalomas.** 1 ♀ Playa del Inglés, 27.749, -15.578, 05 Sep. 2020, Carlos Velázquez Padrón *leg.*

Identification. *Xylocopa pubescens* was identified at subgenus level (*Koptortosoma*) by its external morphology. It is morphologically unique among Canary Island bees; the only species of *Xylocopa* on the archipelago is *X. violacea*. From this last species, *X. pubescens* can be easily differentiated by the mesosoma covered dorsally with yellow hairs. Males are smaller than females, and they can be distinguished by a narrow head and yellow pubescence covering their entire body (Fig. 1). However due to morphological similarities with related species such as *X. modesta* Smith, 1854 from Cape Verde, *X. aestuans* (Linnaeus, 1758) from Southeast Asia or *X. appendiculata* Smith, 1852 (introduced in North America), a molecular identification through barcode was accomplished. An individual from Las Palmas de Gran Canaria city was successfully sequenced for the barcode region of mitochondrial *cox1*. Sequence length was 658 bp (0% ambiguities) with no evidence of stop codons or NUMTs. Comparison with the DNA barcode library using the BOLD ID Engine resulted in a 99.35% of similarity with an exemplar of *X. pubescens* from Fes-Boulemane Region (Rif region, North of Morocco). Individuals from Cyprus and Israel showed lower similarity (99.23–99.07%). NCBI Blast resulted in 97.26% of similarity with the related species *Xylocopa aestuans*.

Distribution

Xylocopa pubescens is naturally distributed in Near-East and North Africa. The species is expanding its native range, as it has been recently detected in the Balcanic Peninsula



Figure 1. Pictures of *Xylocopa pubescens* (male left; female right) in the Parque de La Ballena (Las Palmas de Gran Canaria). Photos: M. Naranjo.

(Greece; Terzo and Rasmont 2014) and the Iberian Peninsula (South Spain; Ortiz and Pauly 2016). In Gran Canaria, all the new records are restricted to the North in Las Palmas de Gran Canaria city, in the surroundings of the port and large urban gardens; additionally, there is one record from the southern tip of Gran Canaria in La Playa del Inglés (Fig. 2). A social network member reported a previous sighting in 2019 in the area where the current sightings occurred, which suggests that the species has been on the island for at least one year.

Discussion

The occurrence of *Xylocopa pubescens* in the island of Gran Canaria can be explained by two alternative scenarios. It may have arrived in a shipment of wood in the port of Las Palmas, with a secondary expansion up to Maspalomas. This hypothesis is supported by its wide distribution around the port area of the capital (Fig. 1). The port receive more than one million containers a year (<http://www.palmasport.es/es/puerto-de-las-palmas/>). The fact that other *Xylocopa* species have been commonly intercepted in wood shipments elsewhere (e.g. San Francisco: Hurd 1955; Japan: Maidl 1912), and

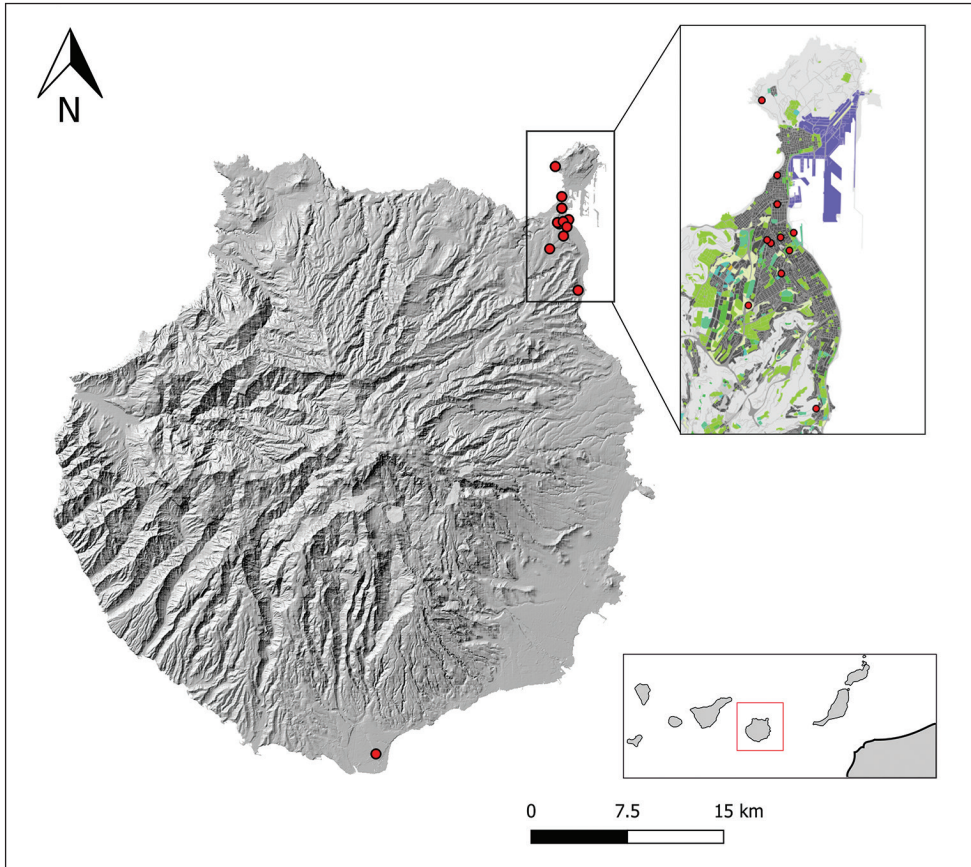


Figure 2. Localities where *Xylocopa pubescens* has been recorded in Gran Canaria island (red dots). A detailed distribution in Las Palmas de Gran Canaria city is presented, showing urban areas (grey) and the port of Las Palmas (in blue).

this large volume of containers trading-off, make possible the accidental arrival and posterior dispersal of this species across the urban area of Las Palmas de Gran Canaria. Wood- or stem-nesting bees, such as those of the family Megachilidae or the genus *Xylocopa*, are known to disperse further by transported nests to isolated islands than by flight (Michener 1979; Poulsen and Rasmussen 2020). Globalization has accelerated this process, thus favouring the introduction of species as carpenter bees that nest in wood or other commercial substrates. In the last decade, several exotic wood nesting bees have been reported in the Canary Islands such as *X. violacea* (Ortiz et al. 2016) or *Megachile otomita* Cresson, 1878 (Strudwick and Jacobi 2018).

Alternatively, *X. pubescens* may have arrived by its own means, transported by the warm east-wind from the Moroccan desert (locally known as ‘calima’). *X. pubescens* is adapted to xeric conditions, and it is likely expanding its native range by colonizing southern Europe in two independent events during the last decade, probably in

relation with the global climate change. Therefore, a natural expansion to the Canary Islands cannot be ruled out. This process may also explain the record of the species in an isolated locality at the very south of Gran Canaria. Future genetic analysis including continental populations should be conducted to discern between both hypotheses.

The species is conspicuous with local abundance in the surroundings of Las Palmas de Gran Canaria and it has been widely observed during the summer and autumn of 2020. The potential negative effects on native bees has not been evaluated yet, therefore it is important to continue monitoring its spread on the island and to assess its possible impacts on island ecosystems. These results provide an example of the potentiality of social media and citizen science for exotic species early detection and monitoring.

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